

Segment Overview (Fiscal 2021)

The Company’s reportable segments were revised effective 2022 to more accurately display the benefits of the strategic allocation of management resources and ongoing revision and asset replacement of business portfolios.

 The defined Core Growth businesses, Fundamental Technologies/Materials businesses, Stable Earnings businesses, and Next-Generation businesses all have a distinctive role within our portfolio. By fulfilling this role with a high degree of competitiveness, these businesses will help us continue to supply the market with new functions and thereby achieve ongoing growth.

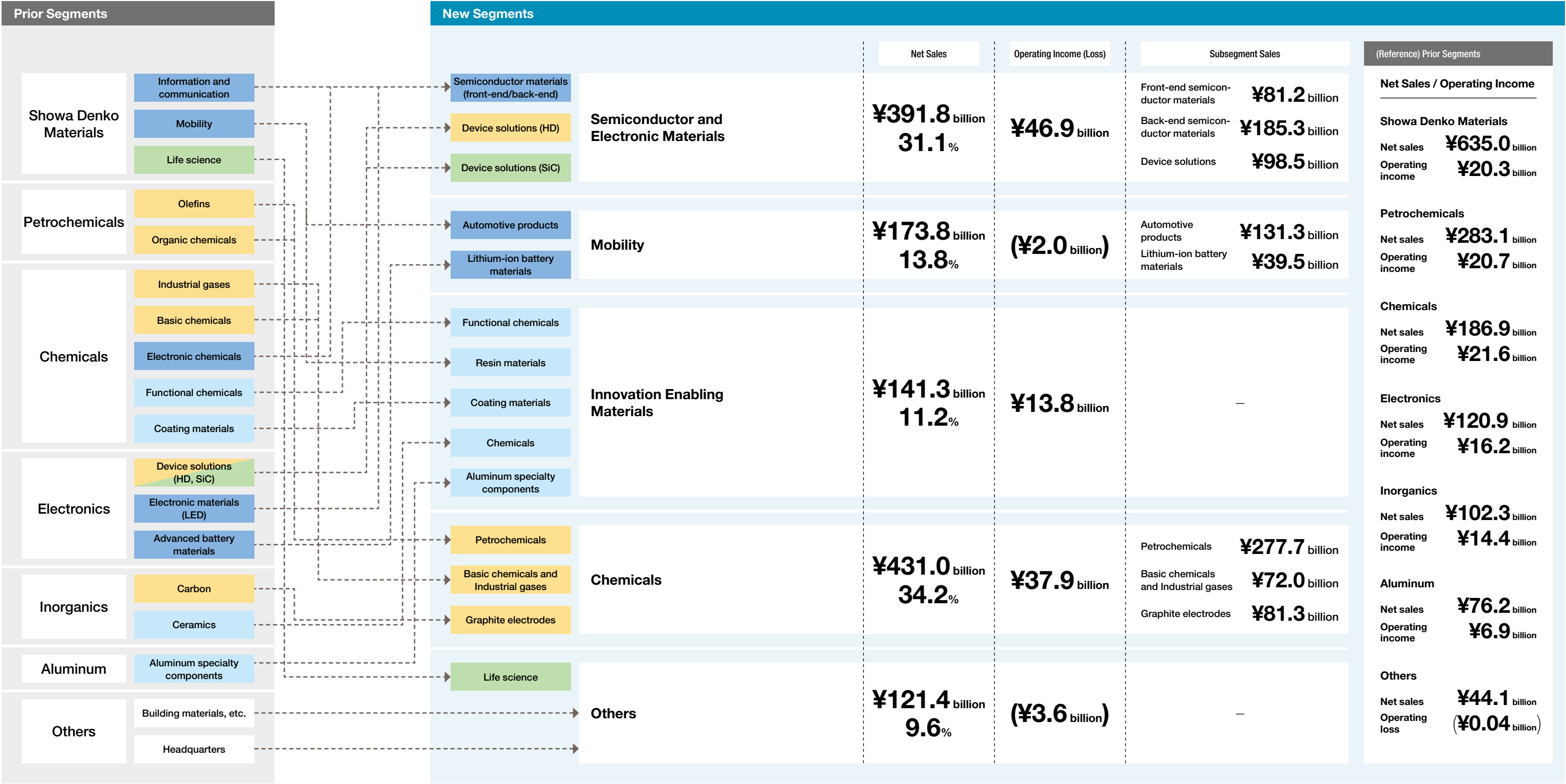
Business category

Core Growth: Invests massively in businesses with huge growth potential

Fundamental Technologies/Materials: Technology platform business to support innovation of other businesses

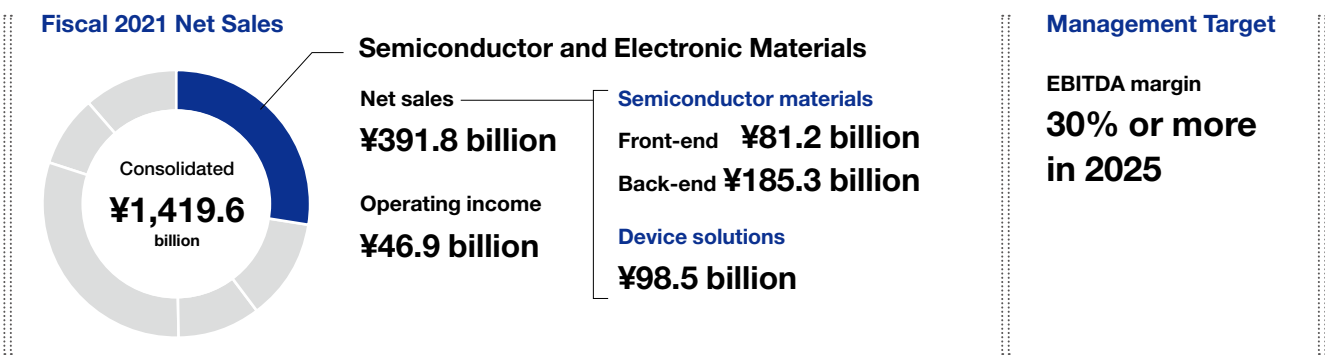
Stable Earnings: Earns a stable profit and generates investment capital for the entire Group

Next-Generation: Promotes investment while verifying viability to develop next-generation pillar businesses





Semiconductor and Electronic Materials



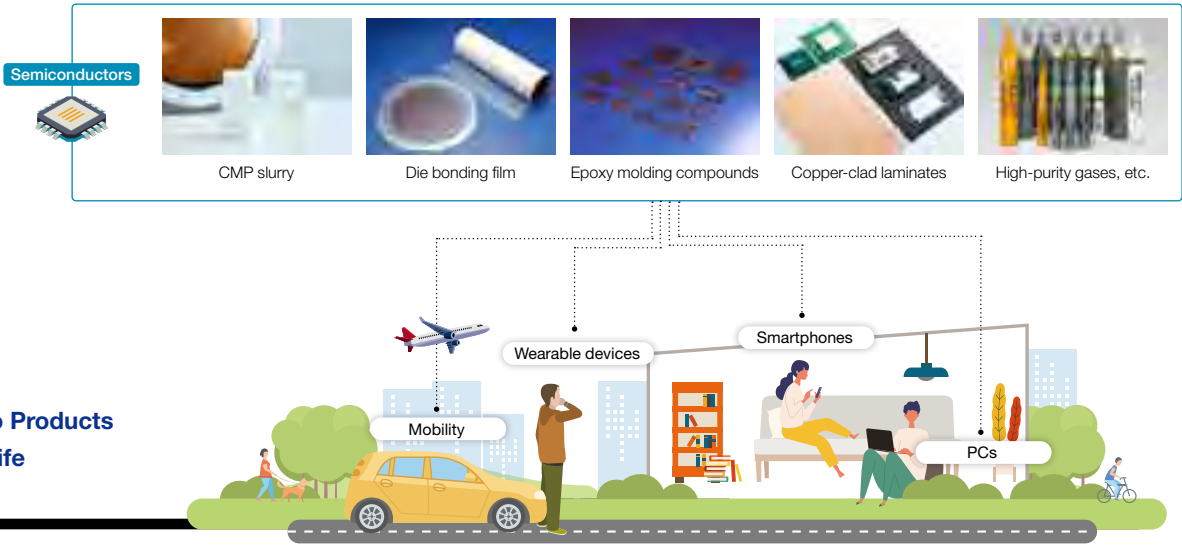
Strategy for Realizing the Long-Term Vision

As a leading global manufacturer, Showa Denko is driving the advancement of semiconductor technologies with its strength in materials. Our front-end and back-end semiconductor materials provide a key technology for contributing to people's happiness while protecting the environment through semiconductor manufacturing processes and end products.

	Results in 2021	Plan for 2022	Vision for the future (2030)
Semiconductor materials Front-end Back-end	<ul style="list-style-type: none">Year-on-year increases in sales and incomeContributions to performance from efforts to build reliable supply structures at bases and bolster production capacity of copper-clad laminates and CMP slurry amid robust demandDecision to establish an advance package verification platform (JOINT2) comprised of substrate, equipment, and material manufacturers to create a de facto standard for next-generation semiconductor packages	<ul style="list-style-type: none">Construction of growth platforms to become a global leaderPreparation of new sales promotion themes and management of pipelines to achieve growth leading up to 2025 (key account strategies, and enhancement of development capabilities from a medium- to long-term perspective)Development of a resilient supply chain management system allowing for swift risk detection and stable supplyFlexible investment plan prescribing timely investment and responsive adaptationVerification and material development of 2.xD, 3D, and other next-generation semiconductor packages through JOINT2 activities	<ul style="list-style-type: none">Goal of becoming a world-leading semiconductor material manufacturer that supports the advancement of a sustainable, digital societyContribution to the realization of a sustainable society by conserving energy and reducing environmental impacts through the supply of advanced semiconductor materialsGrowth outpacing the market
Device solutions (HD)	<ul style="list-style-type: none">Higher demand for large-capacity HD media used in near-line servers for use in data centers; robust demand for HD media employed in PCs due to the spread of teleworking and online learningConclusion of a joint development contract of HAMR^{*1}-based next-generation HD media with SeagateStart of mass production of MAMR^{*2} HD media for ToshibaDevelopment of MAS-MAMR^{*3} HD media as second-generation MAMR mediaExpanded aluminum substrate production capacity and improvement of productivity	<ul style="list-style-type: none">Growth of sales centered on media for large-capacity near-line servers, demand for which is rapidly increasing, through industry-leading development and mass production of best-in-class HD mediaMaximization of aluminum substrate and media production capacity through improvement of efficiency and operating rates at existing production facilitiesPromotion of cost reduction to compensate for increases in fixed costs caused by higher production and sales volumes and rises in raw material prices	<ul style="list-style-type: none">Contribution to storage demand supporting increased data traffic volume and transmission speed as a large-capacity media technology leaderDevelopment and mass production of future media technologies to create 100 TB hard disk drivesAcceleration of integration of digital transformation and automation of production activities and virtual linkage of multiple factories, to be operated as onePursuit of sustainability through production activities and recycling of post-sale products
Device solutions (SiC)	<ul style="list-style-type: none">Conclusion of a sales and joint development contract with Infineon Technologies AGConclusion of a long-term supply contract with ROHM Co., Ltd.Conclusion of a long-term supply contract with Toshiba Electronic Devices & Storage CorporationSignificant increase in sales volumes due to long-term supply contracts, allowing for the posting of operating income	<ul style="list-style-type: none">Response to growth in demand centered on automotive and industrial products amid accelerated energy conservation and decarbonization trendsProvision of best-in-class SiC epitaxial wafers with high reliability and low cost for high voltage and high current applicationsTimely plans to expand production capacity based on trends in growing markets	<ul style="list-style-type: none">Provision of solutions as SiC epitaxial wafer technology leader in response to rapid growth in demand for SiC power semiconductors amid an accelerated global push for carbon neutralityProactive supply of high-value-added products (MOSFETs, high-voltage-resistant Schottky barrier diodes) in response to more sophisticated and specialized quality requirementsLaunch and mass production of eight-inch wafers to help reduce costs of SiC power semiconductors

^{*1} HAMR: Heat-assisted magnetic recording
^{*2} MAMR: Microwave-assisted magnetic recording
^{*3} MAS-MAMR: Microwave-assisted switching microwave-assisted magnetic recording

Showa Denko Products in Everyday Life



Competitive Edge

Operating Environment Outlook and Showa Denko's Strategy
Robust growth in semiconductor demand is anticipated as a result of progress toward a digital society, and it is thus incredibly likely that technological advancement and market growth will continue within a certain scope of technological development. The positions of market participants have already been solidified in this market. While there is some chance that industry reorganization may take place, it is unlikely that an upheaval in the industry structure or the emergence of a significant new player will occur. Based on this outlook, the Semiconductor and Electronic Materials segment will act in accordance with its position as a Core Growth business to develop highly competitive operations with a lineup that encompasses comprehensive solutions and a wide variety of front-end and back-end semiconductor materials.

Risks faced by the Semiconductor and Electronic Materials segment include the potential for increases in raw material, energy, or logistics costs or supply chain disruptions as a result of geopolitical risks. To counter these risks, the segment is developing a resilient supply chain management system designed to facilitate the swift detection of risks and the stable supply of products to customers. As one facet of these efforts, we are constructing a system for integrated management and tracking of semiconductor production and shipment information in Malaysia and other parts of the Indo-Pacific area. This system is scheduled to be implemented in December 2022.

Semiconductor Material Technology Trends
As semiconductors are endowed with more sophisticated functions, there is a rising need for more minutely detailed circuit patterns to be etched through front-end wafer fabrication processes. Meanwhile, in back-end processes, which generally entail mounting chips made from individual wafers onto substrates, the number of components included on chips and in electronic components is increasing at a rapid pace, creating a rising need for new package structures that use 2.xD and 3D mounting technologies to achieve higher mounting density. These trends are boosting demand for Showa Denko's existing highly functional, high-share materials as well as for the new advanced functional materials under development.

In front-end processes, we facilitate customers' development activities with our CMP slurry (nanoceria slurry) capable of creating precise circuit patterns with 2 nm nodes as well as with our precision etching gases and high-purity solvents. At the same time, we assist production activities around the world with back-end process offerings such as photosensitive dry film, copper-clad laminates, and die bonding film supported by superior functionality and strong supply capabilities.

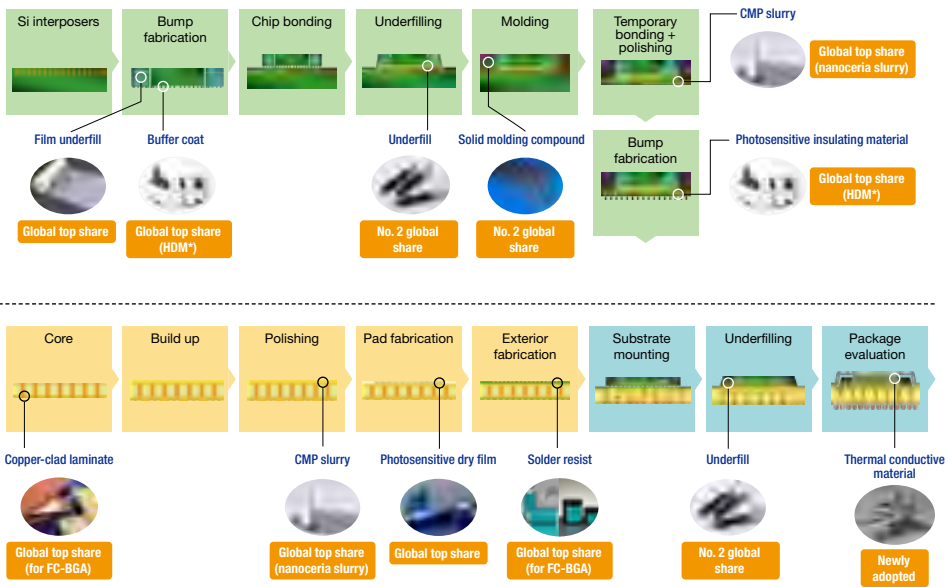
Moreover, Showa Denko is the founding member of the JOINT2 consortium, which is collaborating with regard to substrates, materials, and equipment to help resolve customer issues and accelerate development speeds.

Technological Requirements and Showa Denko's Products

Front-end semiconductor materials	
Technological requirements	Requirement-satisfying products
Precision polishing	CMP slurry (nanoceria slurry)
Precision processing (etching)	High-purity gases for electronic materials
Higher-quality solvents	High-purity solvents

Back-end semiconductor materials	
Technological requirements	Requirement-satisfying products
Close connection, resolution	Photosensitive dry film
High conductivity, low warping	Copper-clad laminates
Reliability	Die bonding materials

Showa Denko's Lineup of 2.xD and 3D Mounting Products and Associated Market Shares



* Shares of HDM (HD Microsystems, Ltd.)
Note: The above global share figures for products are based on Showa Denko's estimates.

Semiconductor and Electronic Materials

Initiatives for Resolving Social Issues as a “Co-creative Chemical Company”

Contributions to the Realization of a Sophisticated Digital Society Characterized by Popularization of Teleworking and 5G and IoT Technologies

Showa Denko Develops HD Media for MAS-MAMR Technology

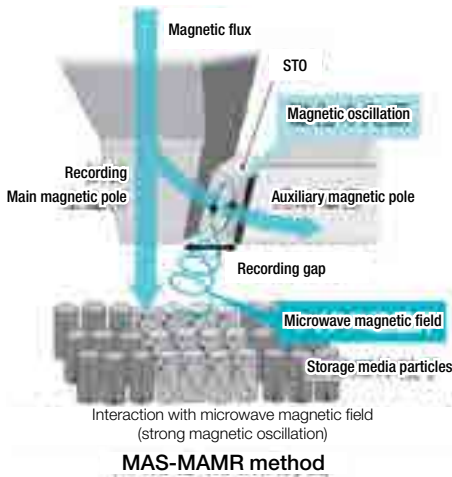
Showa Denko has developed hard disk (HD) media for hard disk drives (HDDs) that support data recording with microwave assisted switching-microwave assisted magnetic recording (MAS-MAMR) technology, which is a next-generation data recording technology based on a new data recording principle suggested by the Toshiba Corporate Research & Development Center and Toshiba Electronic Devices & Storage Corporation (hereinafter collectively called Toshiba).

MAS-MAMR is a next-generation data recording method that can achieve a further increase in the data-storage capacity of HDDs. At present, MAMR is a leading-edge data recording technology that has already been put into practical use. The newly developed MAS-MAMR technology makes possible a data recording track on the surface of HD media that is drastically narrower than that of MAMR-technology-based HD media, through utilization of the strong magnetic oscillation effect of the MAS effect*, thereby increasing the data storage capacity of HDDs.

Aiming to put this new data-recording technology into practical use, Showa Denko has been developing HD media supporting MAS-MAMR in collaboration with Toshiba and TDK Corporation, which is a manufacturer of read/write heads for HDDs. In this joint development program, Showa Denko, Toshiba, and TDK have cooperatively proved for the first time in the world that HDD, as a combination of read/write head equipped with a dual spin-injection-layer (developed by TDK) and HD media equipped with a new-type magnetic layer (developed by SDK), can substantially increase HDDs' data storage capacity through the MAS effect.

On the basis of the results of the technology development program mentioned above, and aiming to realize large-capacity near-line HDDs with storage capacity of more than 30 TB, Showa Denko will accelerate development of HD media supporting MAS-MAMR, which Toshiba aims to put to practical use as the second-generation MAMR.

Showa Denko will accelerate two-way development of HD media supporting MAS-MAMR and heat assisted magnetic recording (HAMR) in accordance with its motto of “Best in class,” thereby developing the best HD media in the world.



* The MAS effect denotes the microwave assisted switching effect. The MAS effect is an effect of strong magnetic oscillation between a spin torque oscillator (STO) and magnetic recording media. This strong magnetic oscillation enables an HDD manufacturer to record digital data on the surface of HD media with a recording track narrower than those of HDDs equipped with conventional magnetic recording technologies.

Initiatives for Resolving Social Issues as a “Co-creative Chemical Company”

Contributions to Energy-Conserving, High-Efficiency, Compact Power Modules

Showa Denko Launches Mass Production of six-inch SiC Single Crystal Wafers

Showa Denko has launched mass production of silicon carbide single crystal wafers (SiC wafers) with a diameter of six inches (150 mm), which are used as materials for SiC epitaxial wafers*1 to be processed and installed into SiC-based power semiconductors (SiC power semiconductors). SiC power semiconductors have excellent heat resistance and high withstanding voltage, much better than those of conventional silicon-based power semiconductors, which are currently the mainstream of power semiconductors. SiC power semiconductors contribute to improvement in a power module's energy efficiency and downsizing. Accordingly, the demand for SiC power semiconductors is increasing rapidly in various fields, especially those for use in electrified vehicles, railcars, and industrial equipment.

As an independent supplier of SiC epitaxial wafers, Showa Denko has the global top share in the market, and has been providing power-device manufacturers with best-in-class SiC epitaxial wafers. Showa Denko's SiC epitaxial wafers are thus highly acclaimed by power device manufacturers both in and outside Japan.

We have even been examining the possibility of starting independent production of SiC wafers. From 2010 to 2015, Showa Denko took part in the Novel Semiconductor Power Electronics Project Realizing Low Carbon Emission Society,*2 which was organized and outsourced by the Ministry of Economy, Trade and Industry (METI) and the New Energy and Industrial Technology Development Organization (NEDO). This is just one of the co-creative venues through which we have been developing mass production technologies.

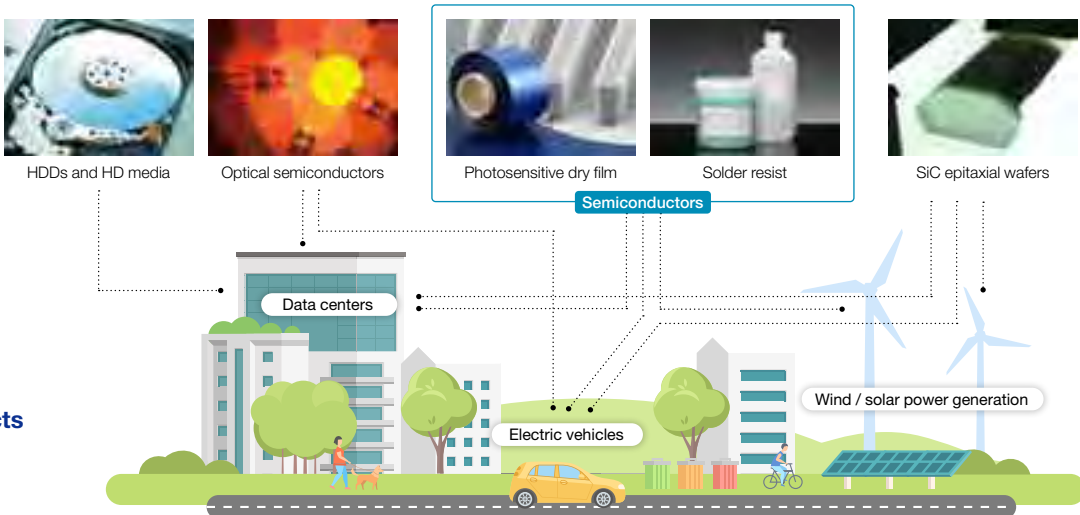
Showa Denko decided to launch in-house mass production of six-inch SiC wafers because plural customers have adopted the Company's SiC epitaxial wafers made from its in-house produced six-inch SiC wafers. On the other hand, the Company will continue purchasing SiC wafers from its partners to respond to rapidly growing demand for SiC epitaxial wafers for power semiconductors. In this way, Showa Denko will diversify the sources of SiC wafers, thereby establishing a stable supply chain for SiC epitaxial wafers.



Six-inch single crystal wafer for SiC power semiconductors

*1 SiC epitaxial wafers are a material for semiconductors made from SiC wafers by depositing a thin layer of epitaxial SiC on the surface of the wafer.

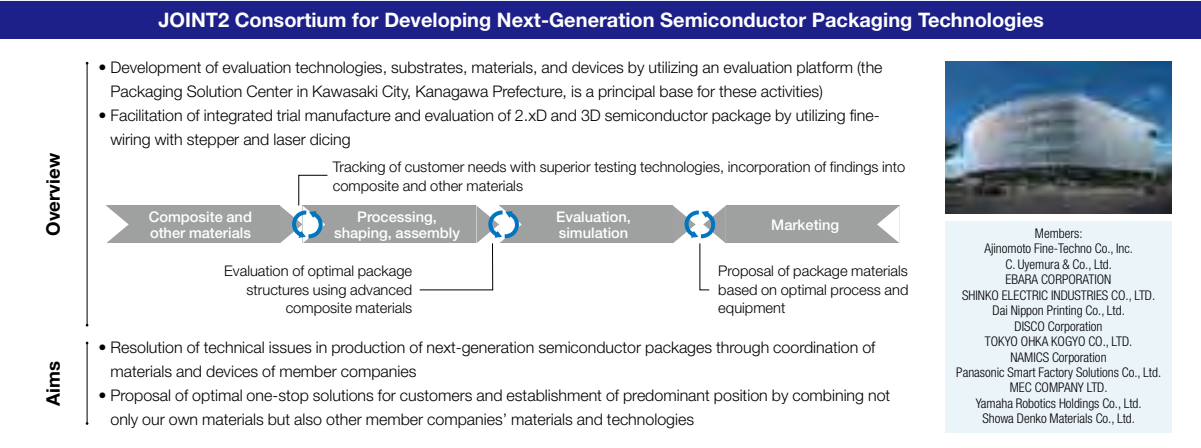
*2 The Novel Semiconductor Power Electronics Project Realizing Low Carbon Emission Society is a project aiming to establish technology to realize a stable supply of SiC wafers with large diameters. In 2010 the project was started and entrusted by METI, and in 2011 control of the project was transferred to NEDO.



Showa Denko Products in Everyday Life

Open Innovation of Semiconductor Package Materials and Processes

Co-creation through JOINT2



The commercial deployment of 5G mobile communication systems is moving forward. It can therefore be expected that we will see the proliferation of post-5G systems featuring ultralow latency*1 and the capacity for multiple simultaneous connection*2 in fields such as autonomous driving and telemedicine. In the past, functions such as logic and memory were installed in different IC chips on substrates. However, accommodating post-5G systems will require an increased density of IC chips and other components to prevent signal latency. Accordingly, there is a need for technologies that allow for high-density packaging of differing chips within a single semiconductor package.

JOINT2, a consortium of 12 companies involved in the development of semiconductor mounting materials, substrates, and equipment, was established in October 2021 with the goal of developing the 2.xD, 3D, and next-generation

semiconductor mounting technologies necessary for telecommunications systems compatible with post-5G systems.

Member companies of JOINT2 have formed multiple working groups through which they share technologies and information via open innovation. In this manner, these companies are teaming up to develop precision bump joining technologies*3 and precision circuit fabrication technologies*4 along with the high-reliability, large-scale substrate technologies necessary for mounting multiple components in order to achieve higher levels of component density on next-generation semiconductors.

*1 Low time lag in communications

*2 Ability for a single substation to accommodate simultaneous connections from multiple devices

*3 Technologies for connecting IC chips and other components in a perpendicular direction using densely fabricated metal protrusions

*4 Technologies for connecting IC chips and other components in a parallel direction using densely fabricated metal protrusions

Japanese companies hold large shares of the global markets for semiconductor materials, substrates, and equipment. However, maintaining our technological edge in these markets will require a platform through which engineers can discuss and evaluate cutting-edge packages. It was this belief that prompted me to propose JOINT2. Private-sector consortiums are rare in this industry, and we therefore face a lot of difficulties as a leading member of the organization. Still, I cannot deny the fact that we are already seeing experiments through JOINT2 produce results more quickly than could have been accomplished alone. I look forward to an even faster pace once we build additional cleanrooms.

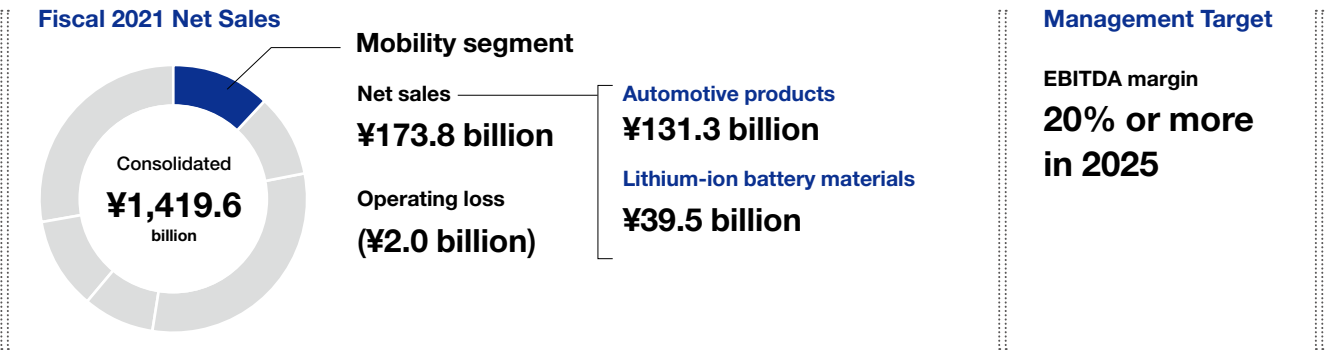


Hidenori Abe

General Manager, Packaging Solution Center



Mobility



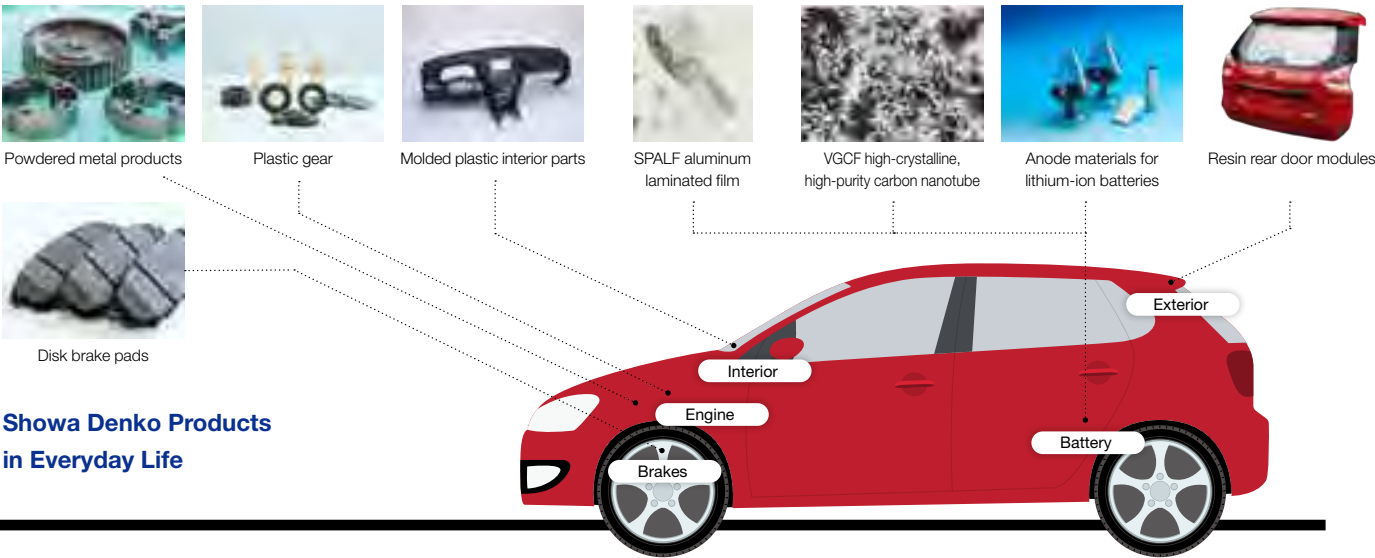
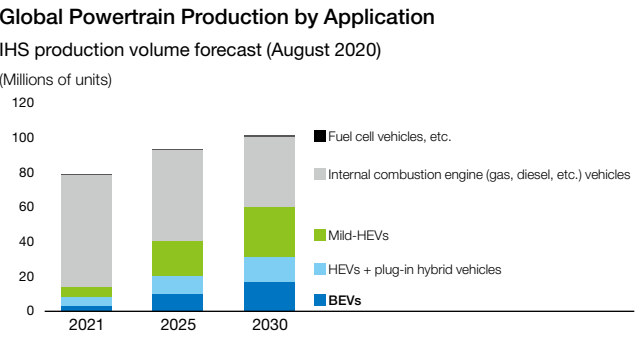
Strategy for Realizing the Long-Term Vision

The Mobility segment is positioning the rising technological needs associated with CASE (connected cars, autonomous/automated driving, shared, and electric) technologies, particularly those related to the development of electrified vehicles, as a business opportunity. To capitalize on this opportunity, the segment is implementing a growth strategy of developing its business while taking advantage of Showa Denko's weight reduction, electrification, and heat control technologies. Moreover, business growth will be pursued by incorporating market growth while positioning CASE-related needs as a key growth driver. The business portfolio of this segment will also be managed with the goal of increasing the ratio of sales from CASE-related products, which was approximately 50% in fiscal 2021, to 65% in fiscal 2025. We thereby aim to accomplish our target of an EBITDA margin of 20% or more.

	Results in 2021	Plan for 2022	Vision for the future (2030)
Automotive products	<ul style="list-style-type: none">Performance lower than initial forecasts, despite recovery in automobile production volume from the impacts of the COVID-19 pandemic in the first half of 2021, due to a decrease in automobile production caused by supply shortages for semiconductors in the second half of 2021Commencement of production of rear door modules and copper-free disk pads for 15 new automobile modelsEstablishment of a production base for rear door modules in Wuhan, China	<ul style="list-style-type: none">Higher sales and income, despite ongoing semiconductor shortages, due to the resumption of recovery trend projected in the second half of 2022Commencement of production of resin rear door modules, interior and exterior parts, and copper-free disk pads for new automobile models; reinforcement of supply chain management to fulfill supply responsibilitiesAggressive investment in products and technologies required for next-generation automobiles, including technologies for weight reduction, electrification, and heat control	<ul style="list-style-type: none">Top share acquired through aggressive investment as a Core Growth business targeting niche marketsEBITDA margin of 20% to be targeted as a Core Growth business
Lithium-ion battery materials	<ul style="list-style-type: none">Expansion of a range of models using Showa Denko anode materials for hybrid-electric vehicles (HEVs) and of related patentsEnhancement of capabilities of SPALF aluminum laminated film and conclusion of a large-scale sales agreement for VGCF conductive additive spanning the period from 2021 to 2022	<ul style="list-style-type: none">Acceleration of development of new anode materials to respond to rapid charging performance and other technical needs of next-generation EVsAcquisition of certification for high-end SPALF models and steady expansion of production capacity and construction of a resilient supply chain for SPALF and VGCF	<ul style="list-style-type: none">Target of net sales of ¥115.0 billion to be achieved by incorporating rising needs associated with the advancement of CASE technologies and pursuit of carbon neutrality

Competitive Edge

The mobility market is currently in a period of great change. To work toward carbon neutrality and address social issues, numerous countries have set CO₂ emissions reduction targets calling for reductions of 30% to 40% over the next decade. Such implementation of stricter environmental regulations is driving growth in demand for electric vehicles (EVs), and it has thus been estimated that EVs will increase to represent more than half of the cars on the road within 10 years. Restrictions are even being placed on electrified vehicles, as the European Union is slated to ban sales of HEVs after 2035. Showa Denko will thus be pursuing business growth by targeting battery-electric vehicles (BEVs), which will no doubt see growth over the long term.



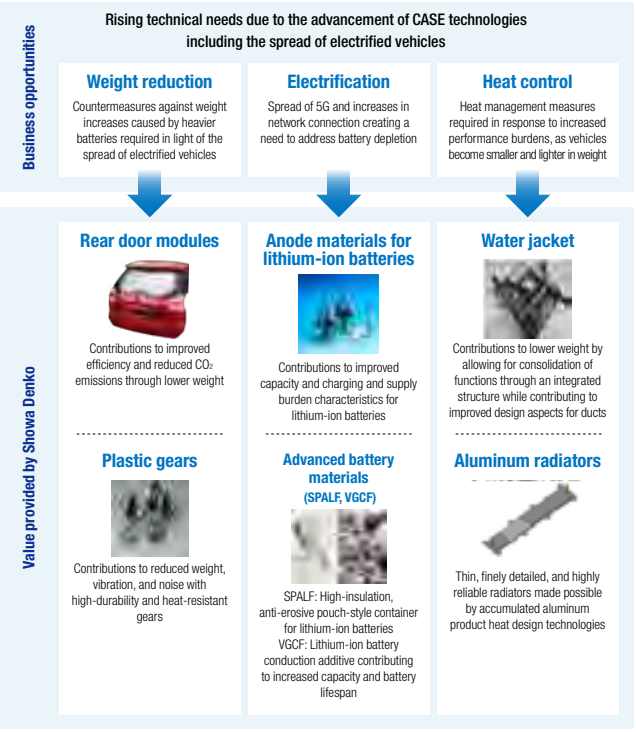
Showa Denko Products in Everyday Life

The Mobility segment aims to expand its business by addressing the needs of the automotive market while positioning CASE-related needs as a key growth driver. This will require us to respond to new technical needs. Accordingly, Showa Denko will be supplying a lineup of battery solutions to accommodate smaller, lighter-weight, and electrified vehicles; material solutions for controlling heat, sound, and electromagnetism; and module solutions that assist in system design tasks such as module development.

At the same time, we will be work to claim the top market share through aggressive investment focused on niche markets.

Specific measures will include the expansion of the range of existing customers' models for which our molded plastic exterior products are used as well as approaching new customers. Our main target in this endeavor will be market segments where we expect to see a strong need for reducing the weight of resin rear door modules while accommodating design concerns. As for composite materials, we will maintain our leading share for mainstay plastic gears while approaching new customers with various heat management products for electrified vehicles. In addition, we will develop a service model for advanced battery materials that satisfies customers' development needs while boosting the quality of SPALF in order to earn the top share in the mobility market.

Growth Strategy for the Mobility Business



Initiatives for Resolving Social Issues as a “Co-creative Chemical Company”

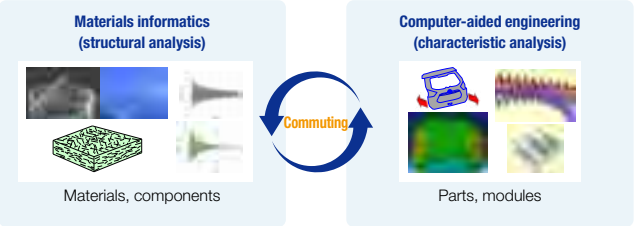
Reinforcement of Development Capabilities through Materials Informatics

Showa Denko faces the need to reinvent its development style. This need is arising in light of factors such as the shorter development lead times required as technical needs and values change in response to trends such as the advancement of CASE technologies and the pursuit of carbon neutrality. Meanwhile, major automobile manufacturers and suppliers are increasingly embracing model-based design, which entails simulating the terminal component functions and performance features necessary for overall automotive systems using virtual models. This design approach makes it possible to adopt a development style in which materials informatics is used to combine various materials selected from databases before computer-aided engineering methodologies are employed to perform analyses and thus conduct prototyping and testing in a virtual environment. Moreover, if we gained the ability to share data and model information with stakeholders, it would be possible to facilitate swift automobile development processes that seamlessly link the designing of materials, components, modules, and automotive systems.

We aim to create a unique model-based design development style by utilizing Companywide materials informatics technologies to

systematically digitize, organize, and compile the insight, experience, and manufacturing insight we have accumulated over our years of working with customers in the mobility field.

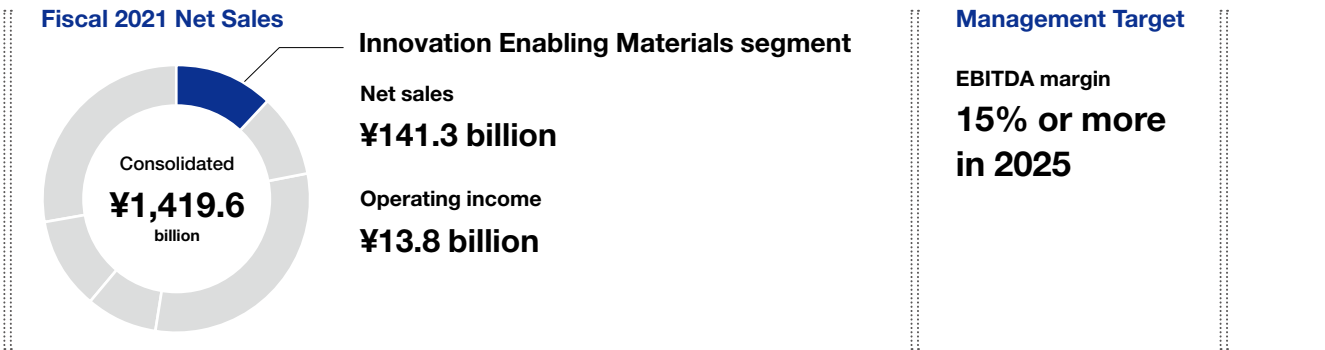
Going forward, we will continue to coordinate with automobile manufacturers and suppliers as well as with industry-academic-government research institutions to develop materials and manufacturing processes and to perform verification tests in local facilities. We thereby hope to continue supply materials, components, and parts that are useful to society.



Showa Denko's Intended Approach toward Model-Based Design



Innovation Enabling Materials



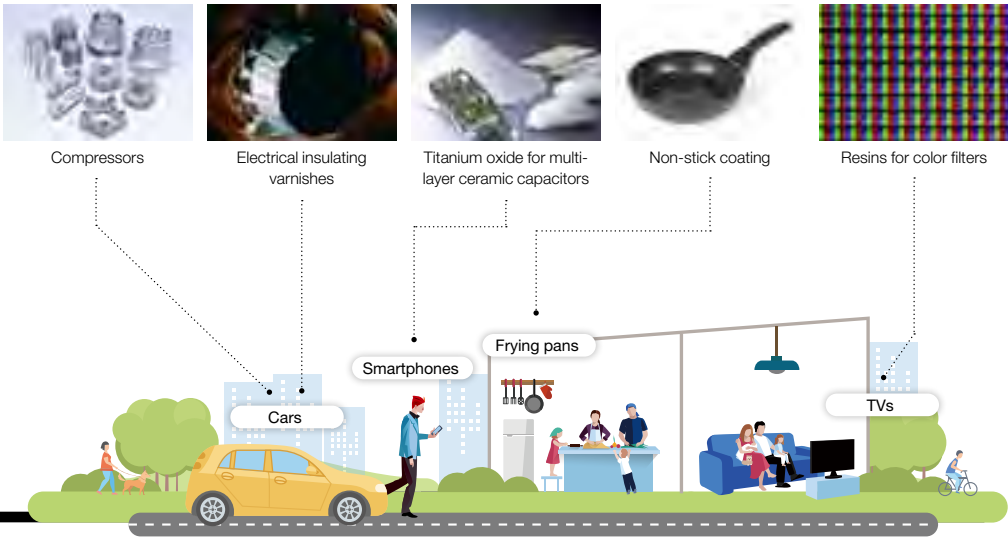
Strategy for Realizing the Long-Term Vision

The Innovation Enabling Materials segment features an extensive lineup of technologies and materials as a technology platform business supporting innovation and competitiveness improvements in Showa Denko's Core Growth, Stable Earnings, and Next-Generation businesses.

This segment strives to remain a step ahead of the changing times by supplying the organic, inorganic, aluminum, and other functional materials deemed valuable by the market. In this way, the Innovation Enabling Materials segment will become a vessel for the creation of new businesses over the medium to long term and a driver behind the fulfillment of our purpose.

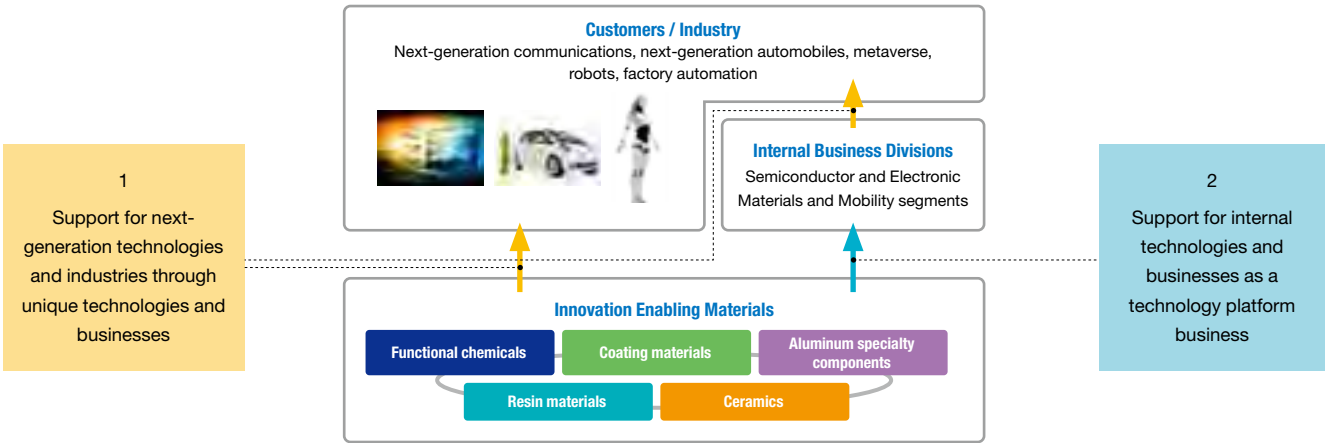
	Results in 2021	Plan for 2022	Vision for the future (2030)
Functional chemicals	<ul style="list-style-type: none">Strong demand centered on the electronic materials marketIncreased profitability driven by structural reforms pertaining to fundamental productsDecision to bolster production capacity for functional materials for use in electronic materialsSynergies generated with Showa Denko Materials	<ul style="list-style-type: none">Stable earnings secured by increasing resilience to operating environment changesIncreased income spread achieved through sales promotions for high-performance, high-margin productsReinforcement of functions and systems for supporting the development of other businessesIntegration with the resin materials business division	<ul style="list-style-type: none">Leader in specific sectors of the global marketProvision of value to society through the ability to aggregate individual strengths
Resin materials	<ul style="list-style-type: none">Recovery from impacts of the COVID-19 pandemic centered on the Chinese marketEstablishment of mass production systems in Japan and China for polyimide varnishes for electrified vehicle motorsGrowth of sales and acquisition of new certifications for semiconductor and electronic materialsStable supply of materials for internal use	<ul style="list-style-type: none">Establishment of earnings structures that are resilient to changes in raw material trendsExpansion of sales of polyimide and polyamide-imide varnishes for electrified vehiclesAccelerated improvements to the product sales mix achieved through a focus on the ratio of sales from new productsResponse to sources of potential future needs in the Semiconductor and Electronic Materials and Mobility segments	<ul style="list-style-type: none">Communication of the benefits of highly competitive functional materials together with the functional chemicals division to help resolve social issues through internal and external effort
Coating materials	<ul style="list-style-type: none">Construction of a factory in Malaysia and the promotion of integrated operation with factories in ChinaDevelopment of new eco-friendly productsAssembly of a dedicated sales team for online sales channelsDevelopment of a joint framework for Group procurement activities	<ul style="list-style-type: none">Extension of the production system into other areas of the worldPromotion of sales of eco-friendly productsBolstering of sales channels for consumer products (emerging countries, online)Expansion of scope of applications and regions of operation for industrial coating materialsDevelopment of new products for growth markets	<ul style="list-style-type: none">Development of the coating business to serve major global players and contribute to Companywide growth as a new business capitalizing on unique composite insight
Ceramics	<ul style="list-style-type: none">Strong performance of materials for electronic device, heat dissipation, and glass polishing applications driven by recovery in demand for electronic devices, high-speed communications, and automotive productsFavorable performance of polishing and refractory materials due to recovery in demand for automotive and steel products	<ul style="list-style-type: none">Ongoing generation of synergies between CMP slurry and heat dissipation materialsAcceleration of development of next-generation materials for electronic devices	<ul style="list-style-type: none">Supply of first-rate ceramics products and services that surpass customer expectations and contribute to the resolution of social issues
Aluminum specialty components	<ul style="list-style-type: none">Robust demand in the first half of 2021 due to recovery from the impacts of the COVID-19 pandemicSluggish growth in sales beginning in the third quarter as a result of semiconductor shortagesHigher costs due to soaring prices of additive metal materials in the fourth quarterImpressive sales of extrusion products for railcars	<ul style="list-style-type: none">Construction of earnings structures that are resilient to operating environment changesDevelopment of next-generation radiatorsApplication of aluminum processing technologies to mass production in pursuit of carbon neutralityReceipt of suspension component orders from around the world	<ul style="list-style-type: none">Contribution to society through the combination of aluminum with other materials

Showa Denko Products in Everyday Life



Competitive Edge

The competitive edge of the Innovation Enabling Materials segment lies in the positioning of its unique technologies and businesses. Moreover, as a technology platform business, it generates intra-segment synergies while supporting the technologies and operations of Core Growth businesses to enhance our technical capabilities and secure a more sophisticated position for its unique technologies and businesses.



Initiatives for Resolving Social Issues as a “Co-creative Chemical Company”

Resin Materials: Electrical Insulating Varnishes

Electrical insulating varnishes contribute to improved functionality in the motors of electrified vehicles. Showa Denko boasts the leading share of 35% (based on estimates by the Company) in the Japan market for polyimide and polyamide-imide resin varnishes, which require particularly high levels of durability and reliability, together with a large share of the global market.

Coating materials: Non-Stick Coatings

Together with customers producing cooking utensils, Showa Denko is rolling out its MAXIMIZING green campaign designed to communicate the sustainability principles exemplified by the materials used in cooking utensils directly to end users. Carried out in Europe, this campaign has proved successful in boosting sales of cooking utensils.

Ceramics: Aluminum Nitride Filler

Showa Denko's aluminum nitride fillers contribute to smaller electronic components with excellent wet resistance and high thermal conductivity. Improving wet resistance is one of the greatest challenges in developing aluminum nitride fillers, but we succeeded in achieving a

massive improvement by utilizing our proprietary ultrathin membrane surface processing technology, allowing our fillers to help create electronic components with higher functionality and longer lifespans.

Functional Chemicals: Isocyanate Monomer

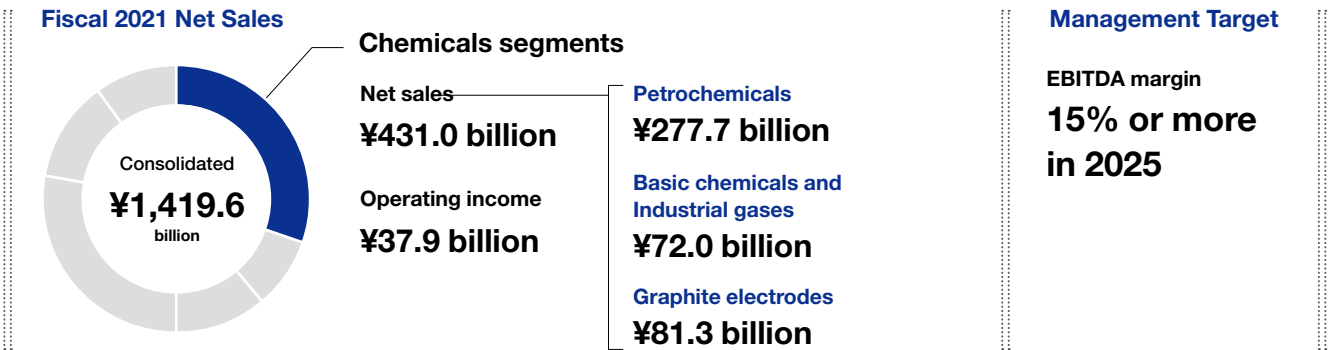
Isocyanate monomers are functional monomers that contain two functions in a single molecule. The increased freedom of molecular design granted by these isocyanate monomers can be used to improve the features of materials for a wide variety of applications, including photosensitive resin materials, paints, and coating materials.

Aluminum Specialty Components: Aluminum Radiators for Electrified Vehicles

Aluminum radiators help to improve the reliability and heat dissipation characteristics of the power modules that are a central component of electrified vehicles as one of the multiple materials employed in these modules. Further increases in the functionality of power modules can be achieved by using our thermal performance simulation technologies, power module mounting technologies, and multi-material optimization technologies.



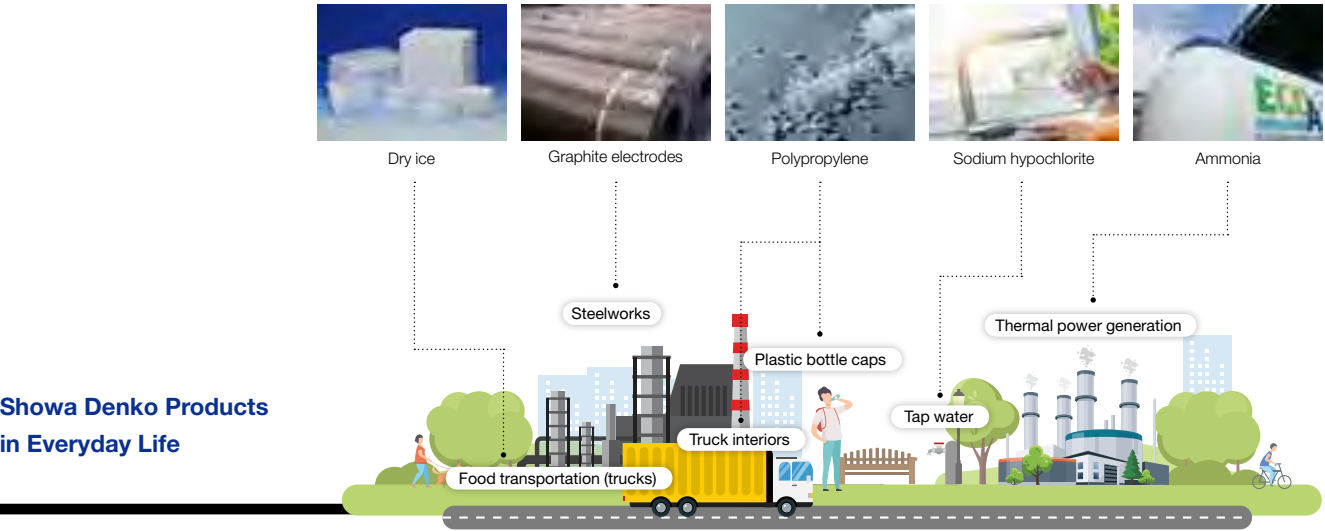
Chemicals



Strategy for Realizing the Long-Term Vision

The Chemicals segment has a broad-ranging lineup of highly competitive, high-share products, including olefins, organic chemicals, graphite electrodes and other carbon products, basic chemicals, and industrial gases. With this lineup of products that function as the building blocks of various industries and infrastructure, this segment continues to contribute to society through safe and secure operations. At the same time, improvements to production processes are being pursued with the goal of contributing to the happiness and prosperity of people and to harmony with the global environment.

	Results in 2021	Plan for 2022	Vision for the future (2030)
Petro-chemicals	<ul style="list-style-type: none">Greater-than-expected recovery in demand after the impacts of the COVID-19 pandemicIncreases in product market prices due to a more favorable balance of supply and demandContributions to higher earnings following rises in the price of naphtha (difference between the receipts and disbursements of raw materials and products)Massive year-on-year increase in operating income	<ul style="list-style-type: none">Continuation of strong demandLooser balance of supply and demand due to construction of additional facilities in AsiaGreater-than-expected market deterioration continuing since the start of 2022Rising costs due to higher prices for crude oil and naphthaDecrease in production volume as a result of shutdown maintenance of the Oita Petrochemical Complex conducted once every four years	<ul style="list-style-type: none">Improvements to profitability and efforts to limit volatility in earningsReduction of 30% in CO₂ emissions from the Oita Petrochemical Complex in comparison to 2013
Basic chemicals and Industrial gases	<ul style="list-style-type: none">Greater-than-expected recovery in demand after the impacts of the COVID-19 pandemicSubstantial improvement in the earnings structure due to a tighter balance of supply and demandRecord-breaking operating incomeHigher costs due to logistics stagnation and a rise in raw material/fuel prices seen in the second half of 2021	<ul style="list-style-type: none">Continuation of strong demandOngoing logistics stagnationProlonged rise in costs due to soaring raw material/fuel pricesAggregate volume of used plastic recycled reached one million tons in January 2022	<ul style="list-style-type: none">Promotion of the popularization of low-carbon ammoniaCreation of a hydrogen use network together with companies near the coastal area of Kawasaki City
Graphite electrodes	<ul style="list-style-type: none">Alleviation of surplus graphite electrode inventories of customersAchievement of the No. 1 global share of sales and production volume in the three-month period from October to December 2021Decrease in use of blast furnaces and increase in use of electric furnaces in the global steel production industry from an ESG perspective (resulting in growth in demand for graphite electrodes)Higher sales and income following recovery in demand for steel and electrodes	<ul style="list-style-type: none">Increased use of renewable energy<ol style="list-style-type: none">Utilization of big data for management of water intake; maximization of hydroelectric power generation volume through sophisticated prediction of water volume fluctuationsGlobal expansion (starting with Europe)Pursuit of synergies with AMI Automation (sale of electric furnace operation optimization software, etc.)<p>Analysis of the relationship between furnace operating conditions and electrode quality (data science)</p>Expansion of strategic supply partnerships with customersMaximization of sales volume at prices ensuring an appropriate spreadImprovement in cost-competitiveness	<ul style="list-style-type: none">Stable supply of electrodes supporting a global transition toward electric furnaces as the No. 1 global supplierContributions to the development of zero-emissions electric furnacesReductions in CO₂ emissions (30% reduction from 2013) and in waste and use of renewable energy at factoriesStable operation of water system underpinning the plan of Omachi City, Nagano Prefecture, to evolve into a futuristic city based on the principles of the SDGs and maximization of community water system efficiency through utilization of natural resources and big data



Showa Denko Products
in Everyday Life

Competitive Edge

Petrochemicals

Policies

We will seek to boost competitiveness and help achieve carbon neutrality in 2050 based on our vision of developing a sustainable business that consistently generates high profits.

Major Products

Olefins, organic chemicals

Business Strengths

- The Oita Petrochemical Complex is located in close proximity to the Asian market, giving this export base one of the greatest geographical advantages in Japan in terms of logistics. We anticipate that we will have access to an increased range of business opportunities as demand for petrochemical products grows overseas.
- The capacities of our equipment and our operating track record enable us to accommodate a diverse range of ethylene feedstock, giving us the ability to respond flexibly to changes in the volatile raw material market.
- We boast a lineup of unique, high-market-share acetyl derivatives (ethyl acetate, n-Propyl acetate, and allyl alcohol) that take advantage of proprietary catalysts and processes, and we hold the top share in the Japanese market for these products.
- Our lineup of reliable olefin derivatives (polyethylene, polypropylene, etc.), assembled through alliances in Japan, make us competitive in high-value-added fields.
- Development is underway for a low-concentration CO₂ separation system employing an innovative separation agent to further our quest toward carbon neutrality in 2050 (➡ P.52).

Basic chemicals and Industrial gases

Policies

Foundations are being developed so that we can become Asia's foremost chemical supplier.

Major Products

Industrial gases, basic chemicals

Business Strengths

- Capitalizing on the advantageous urban location of the Kawasaki Plant, we are catering to needs for a diverse range of functional chemicals including industrial gases, fiber materials, high-purity gas for semiconductor production, and medical and agricultural materials.
- Chemical recycling technologies are being utilized to produce ammonia using hydrogen extracted from used plastic. As a result of these efforts, the amount of used plastic recycled reached one million tons in January 2022. Moreover, the CO₂ emitted during manufacturing processes is used to produce dry ice and liquid CO₂, meaning that our operations produce effectively zero emissions (➡ P.52).

Graphite electrodes

Policies

By supplying the world's best electrodes coupled with unparalleled services, we will promote efficient and eco-friendly steel recycling and thereby contribute to the sustainable development of society.

Major Products

Graphite electrodes

Business Strengths

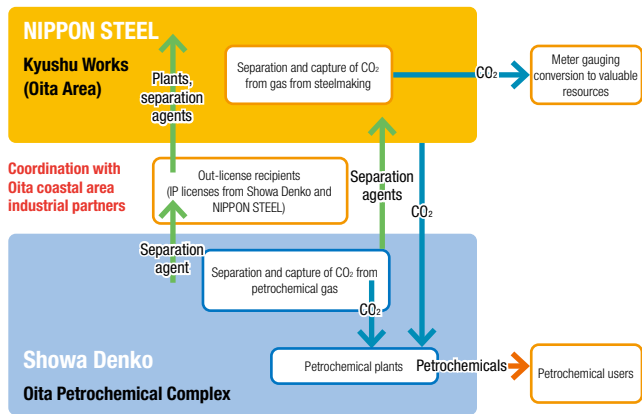
- With the No. 1 position in the global market and the ability to ship electrodes from production bases in six countries, we are promoting local production and consumption in the United States, Europe, and Asia.
- Our base of more than 200 customers around the world is being utilized to engage in strategic supply partnerships with customers who share our values, in order to stabilize operations. Such partnerships are also leading to increased operational stability in terms of procurement.
- Through our partnership with AMI Automation, we are working together with customers to enhance operations at production sites via digital technologies for optimizing electric furnace operating conditions. Electric furnaces are an effective means of conserving energy and cutting CO₂ emissions (reduced equipment damage, increased electricity efficiency in production processes, higher electrode output) (➡ P.52).
- We are promoting renewable energy use on a global scale. In Japan, for example, we are using hydroelectric power as the primary power source at the Omachi Plant. We have also commenced long-term procurement of renewable energy in Europe (➡ P.64).

Chemicals

Initiatives for Resolving Social Issues as a “Co-creative Chemical Company”

Petrochemicals: CO₂ Capture and Use Initiatives to Achieve Carbon Neutrality

Showa Denko has teamed up with NIPPON STEEL CORPORATION in a co-creative venture to develop a low-concentration CO₂ separation system that employs an innovative separation agent. In May 2022, this initiative was adopted for the CO₂ separation and capture technology development project of NEDO under its Green Innovation Fund. Together with NIPPON STEEL CORPORATION, we are developing technologies for the low-cost separation and capture of low-pressure, low-concentration CO₂ from sources such as factory exhaust gas, while verifying the feasibility of technologies for producing chemical products from captured CO₂. We anticipate that these technologies will allow us to develop and grow CO₂ separation and capture plant operations and separation agent operations. The technology is also expected to give rise to chemical business models that use CO₂ and are thus not dependent on fossil resources, and thereby contribute to carbon neutrality.

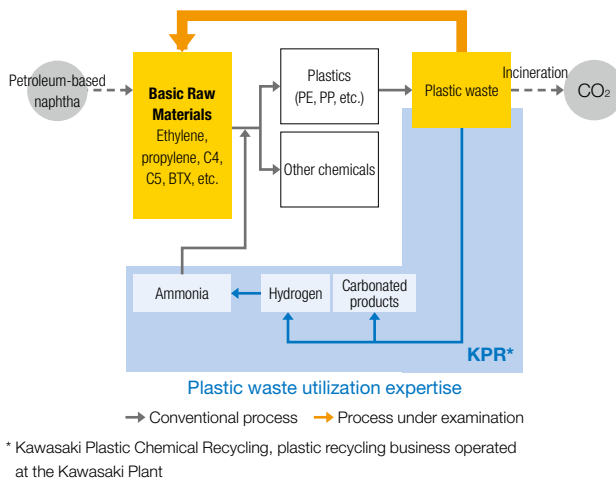


Basic chemicals and Industrial gases:

Co-creative Plastic Chemical Recycling and Large-Scale Hydrogen Use Initiatives

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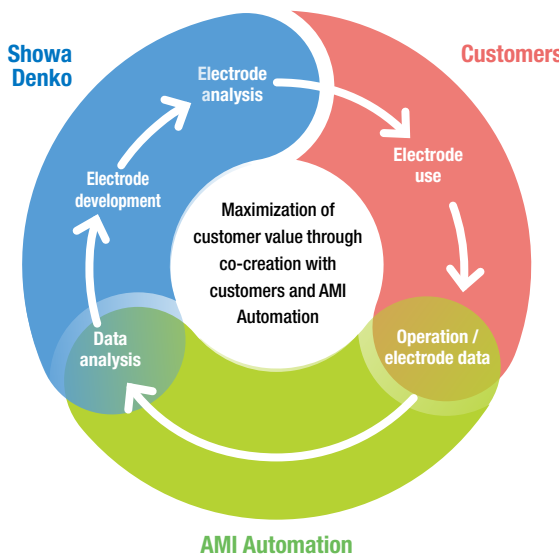
Showa Denko's Kawasaki Plant is developing its Kawasaki Plastic Chemical Recycling* operations through which it decomposes used plastics to extract hydrogen. The hydrogen collected in this manner is utilized for a variety of initiatives, including verification tests of supply for fuel cells for hotels. Showa Denko is a world leader in synthesizing ammonia by utilizing low-carbon hydrogen extracted from gas produced through the process of used plastic chemical recycling. We have been producing ammonia in this manner for many years, and as a result the total volume of used plastic recycled reached one million tons in January 2022. Moreover, the Company began examining the possibility of establishing a base in the coastal area of Kawasaki City to create a cycle for expanding supply and demand to use hydrogen in this manner. Under the envisioned scheme, we would coordinate with seven partners from various industries to form a carbon use network to track medium- to long-term hydrogen demand and supply network feasibility within the area.



* Kawasaki Plastic Chemical Recycling, plastic recycling business operated at the Kawasaki Plant

Graphite electrodes: Maximization of Customer Value in the Steel Recycling Process through Digital Transformation

Showa Denko is the No. 1 global manufacturer of the graphite electrodes that are indispensable to the electric furnaces used to melt iron scraps as part of the steelmaking process. To further build upon these operations, in 2021 we acquired a stake in Mexico-based AMI Automation, a global provider of sophisticated electrode elevation control systems and other services for optimizing the operation of electric furnaces. By strengthening our relationship with this company, we aim to contribute to the maximization of value for customers through a service lineup that expands beyond the sale of graphite electrodes to include operational support and the development of optimal electrodes. Moreover, in 2022 we began collecting operating data from customers' electric furnaces to perform big data analyses for use in proposing optimal electric furnace operating conditions, constructing optimized electrode development systems, and enhancing data science initiatives. In this manner, we will pursue ongoing improvements in the value that we provide to customers through co-creation with these customers and with AMI Automation.



Others

Life Science

Contribution to Healthy and Fulfilling Lifestyles



Minaris Regenerative Medicine, LLC, is a global provider of services specializing in regenerative medicines including clinical trials and contract manufacturing.



Minaris Medical Co., Ltd., has cultivated a solid operating foundation over its more than 40 years of operation and is able to supply in vitro diagnostic products for various fields including clinical chemistry and immunology.

Minaris is Showa Denko's life science brand.

Strategy for Realizing the Long-Term Vision

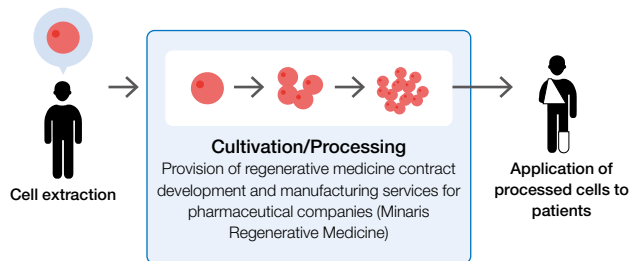
The life science business has been positioned as a pillar of Next-Generation businesses. In this business, we are engaged in manufacturing process development and contract manufacturing of regenerative medicines and the production and sale of in vitro diagnostic products. In 2020, the names of certain life science business Group companies and products were changed to unite them under the Minaris brand, to enable the development of global operations under a stronger brand.

	Results in 2021	Plan for 2022	Vision for the future (2030)
Regenerative medicine	<ul style="list-style-type: none">Establishment of a manufacturing base network encompassing three regions (North America, Europe, and Japan)Development of a manufacturing base network (start of the expansion of bases on the east coast of North America and construction of a second factory in Germany)	<ul style="list-style-type: none">Augmentation of production facilities to improve quality and efficiency (completion of the expansion of bases on the east coast of North America, advancement of construction of a second factory in Germany that is scheduled to commence operations in 2024, and the full-fledged start of regenerative medicine production in Japan)Construction a high-quality, high-efficiency manufacturing network through introduction of IT systems at bases	<ul style="list-style-type: none">Provision of high-quality regenerative medicine contract manufacturing services out of bases in North America, Europe, and Japan as a partner to pharmaceutical companies, to contribute to the development and popularization of regenerative medicine and subsequently healthy and fulfilling lifestyles for people around the world
Medical products	<ul style="list-style-type: none">Acquisition of approval for a new allergy diagnostic reagent panel from the U.S. Food and Drug Administration (FDA)Commencement of joint development with the National Cancer Center of a fast COVID-19 test using cellular immunity methodology	<ul style="list-style-type: none">Expansions of the share for cholesterol lipid and diabetes HbA1c reagentsStart of shipments of creatinine kidney disease reagents for overseas marketsAcceleration of new product development combining FDA approval processes and point of care testing technologies through coordination with the U.S. reagent subsidiary and a U.S. research institution	<ul style="list-style-type: none">Establishment of a position as a global company by bolstering operations in distinctive areas of strength and creation of diagnosis technologies and products to support prevention, diagnosis, and treatment, to realize personalized medicine

Initiatives for Resolving Social Issues as a “Co-creative Chemical Company”

Regenerative Medicine

With bases in North America, Europe, and Japan, Minaris Regenerative Medicine supplies contract manufacturing services, through which it produces reliable, high-quality regenerative medicine products on a global basis. These services can be used to produce regenerative medicines with the same level of quality as conventional pharmaceuticals, regardless of whether these medicines are derived from T-cells, mesenchymal stem cells, iPS cells, or some other type of cell, autologous or allogeneic. Contributions are made to Minaris Regenerative Medicine's pharmaceutical company customers through the supply of these medicines. Moreover, the provision of safe and effective regenerative medicines to patients through customers helps society to combat intractable and recurrent diseases that are difficult to treat with conventional methods, such as cancer and hereditary disorders.



Medical Products

It is expected that the role of clinical examinations will grow increasingly important in the years ahead, as examinations are used to treat diseases based on evidence and prevent pre-symptomatic lifestyle diseases, and thereby extend people's lifespans. Minaris Medical has a long history of providing diagnostic products, dating back to its commercialization of the enzyme-method reagent for measuring total cholesterol in 1975. In the years that followed, this company went on to provide a biochemical test for diseases such as hyperlipidemia and diabetes as well as in vitro diagnostic products such as allergy immunological tests and medical devices. Looking ahead, we will strive to create technologies, products, and services to support prevention, diagnosis, and treatment in order to realize personalized medicine. In this way, Minaris Medical will seek to become the company patients choose by contributing to healthy and fulfilling lifestyles through the supply of new value in clinical examinations.

